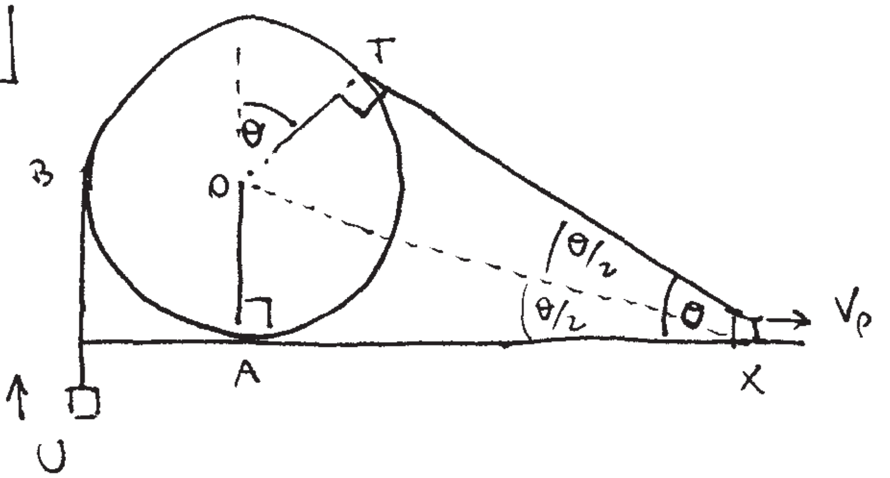
P1



a) $\overline{AX} = R + v_0 t$ (por cond. inicial partícula der.)

por geom: $\tan\frac{\theta}{2} = \frac{\overline{OA}}{\overline{AX}} = \frac{R}{R+v_0 t}$ (1)

en $\theta = \pi/3$ $\tan\pi/6 = \frac{1}{\sqrt{3}} = \frac{R}{R+v_0 \bar{t}}$

sale de Δ equiláter

en ese instante: $R + v_0 \bar{t} = R\sqrt{3}$

derivando (1) c/r al tiempo:

$$\frac{\dot{\theta}}{2}\sec^2\frac{\theta}{2} = \frac{-R v_0}{(R+v_0 t)^2}$$

$$\Rightarrow \quad \dot{\theta} = -\frac{2Rv_0}{(R+v_0 t)^2}\cos^2\frac{\theta}{2}$$

evaluando en $t = \bar{t}$ $\theta = \pi/3$

$$\dot{\theta}\Big|_{\theta=\pi/3} = \frac{-2Rv_0}{(R\sqrt{3})^2}\cos^2\frac{\pi}{6} \qquad \cos\frac{\pi}{6} = \frac{\sqrt{3}}{2}$$

$$= -\frac{2Rv_0}{3R^2}\times\frac{3}{4} = \frac{-v_p}{2R}$$ (negativo, como debía ser)

P1 b) por geometría se tiene: $\overline{AX} = \overline{TX} = R + v_0 t$

$\widehat{BT} = R(\theta + \pi/2)$

$\overline{UB}$ = segmento de cuerda que cuelga

$\overline{UB} + \widehat{BT} + \overline{TX} = \text{const.} = L$ (largo cuerda)

$\overline{UB} + R(\theta + \pi/2) + R + v_0 t = L \quad / \frac{d}{dt}$

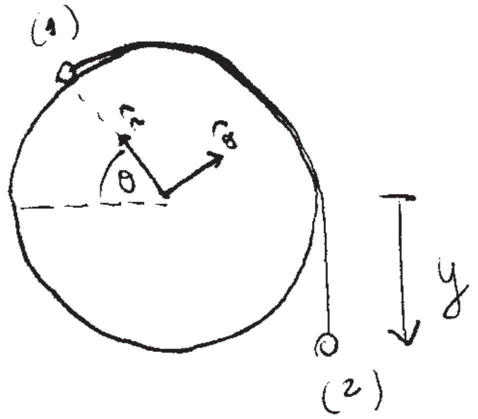
$\Rightarrow \dot{\overline{UB}} + R\dot{\theta} + v_0 = 0$

$\Rightarrow \dot{\overline{UB}} = -R\dot{\theta} - v_0$

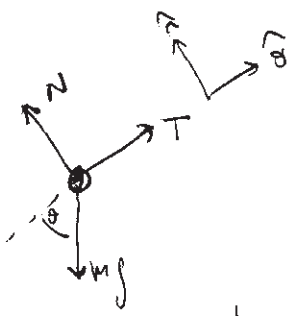
eval. en $\theta = \pi/3 \qquad \dot{\theta} = -\frac{v_0}{2R}$

$\dot{\overline{UB}} = -R\left(-\frac{v_0}{2R}\right) - v_0 = -\frac{v_0}{2}$

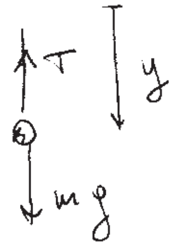
P2



DCL (1)



DCL (2)



$\vec{F} = m\vec{a}$ para (1): $\hat{r}$) $N - mg \,\text{sen}\,\theta = -mR\dot{\theta}^2$ (1)

$\hat{\theta}$) $T - mg\cos\theta = mR\ddot{\theta}$ (2)

para (2) $\quad mg - T = m\ddot{y}$

pero $\underline{y = R\theta} \Rightarrow mg - T = mR\ddot{\theta}$ (3)

$(2) + (3) \Rightarrow \quad mg(1 - \cos\theta) = 2mR\ddot{\theta}$

pero $\ddot{\theta} = \dfrac{d\dot{\theta}}{d\theta}\dot{\theta}$

$\Rightarrow \displaystyle\int_{\dot{\theta}_{inic}=0} \dot{\theta}\, d\dot{\theta} = \frac{g}{2R}\int_0 (1 - \cos\theta)\, d\theta$ dado que $\dot{y}_{inic} = R\dot{\theta}_{inic}$ ($\dot{y}_{inic} = 0$) $\Rightarrow \dot{\theta}_{inic} = 0$

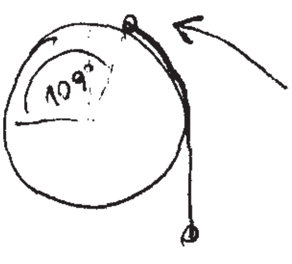
$\Rightarrow \dfrac{\dot{\theta}^2}{2} = \dfrac{g}{2R}(\theta - \text{sen}\,\theta)\Big|_0^\theta$

$$\boxed{\dot{\theta}^2 = \frac{g}{R}(\theta - \text{sen}\,\theta)}$$ esto en (1)

$N = mg\,\text{sen}\,\theta - mR\dot{\theta}^2 = mg\,\text{sen}\,\theta - mg(\theta - \text{sen}\,\theta)$

$$\boxed{N = mg(2\,\text{sen}\,\theta - \theta)}$$ con lo cual $N = 0$ para $\bar{\theta}$ t.q.:

$\text{sen}\,\bar{\theta} = \bar{\theta}/2$ $\quad \bar{\theta} = 0$; $\quad \bar{\theta} = 1{,}897 \simeq 109°$



ahí se despega